Ashok K. Vijh
Elected CRSI Honorary Fellow

Ashok K. Vijh has been elected as one of four new Honorary Fellows of the The Chemical Research Society of India (CRSI) this year. Founded in 1999 as a part of celebrations for India's fiftieth anniversary of independence, CRSI's goal is to promote research at the highest level (http://crsi.org.in). To date, there are 31 Honorary Fellows internationally, including several Nobel laureates. Dr. Vijh is the first person of Indian origin to be added to this elite group. He has been an active member of ECS since 1968.

Dr. Vijh's research is in several areas of physical electrochemistry and materials science. His current work is focused on electrochemical energy conversion and storage, and electrochemical treatment of cancerous tumors. He has authored over 300 refereed publications, including several books and chapters.

Dr. Vijh is a Fellow of American Physical Society, Institute of Electrical and Electronic Engineers (IEEE), the Royal Society of Chemistry (UK), and the Institute of Physics (UK). Over his long career, his work has been recognized by over forty major prizes, awards, medals, decorations, and other distinctions. He has been decorated as an Officer of the Order of Canada and as an Officer of the National Order of Québec. He has also received honorary doctorates from three universities.

From 2005-2007, he served as the elected President of the Academy of Science of the Royal Society of Canada and as a Vice-President of the Royal Society of Canada. In addition, he has been elected a Foreign/Titular Fellow of several other academies including the European Academy of Science, Arts and Humanities (Paris), The Academy of Sciences of the Developing World (TWAS, based in Trieste, Italy), and the Indian National Science Academy (INSA). He also serves on the editorial boards of several international journals.

He is a Maître-de-Recherche at the Institut de Recherche d'Hydro-Québec, and concurrently an invited professor at the National Institute of Scientific Research (INRS) of the Université du Québec, both in Varennes, Québec.

In Memoriam

Helen Huff
(1938-2009)

Helen Huff passed away on May 18, 2009, after a strong and valiant fight the past two years, against Amyotrophic Lateral Sclerosis (ALS), commonly known as "Lou Gehrig's Disease." While Helen herself was not a member of ECS, she was well-known to many of us as the behind-the-scenes "organizer" who kept the extremely successful Semiconductor Silicon Symposium series on the "straight and narrow." She always attended ECS meetings and added a great deal of fun to the "companion registrants" group, learning to dance the hula in Hawaii or contributing to the book discussion, all while keeping track of the many authors who contributed to the symposium's book.

Helen Huff is shown in the photo at left accepting roses from her husband Howard Huff, in May 2006, at the ECS meeting in Denver CO, in appreciation of her excellent work for the Tenth Semiconductor Silicon Symposium. Helen was for many years the secretariat of the series, co-edited by Howard Huff for close to forty years.

Helen is survived by her husband, Howard, and their children, Sharon Sue, Debra Anne, and Louis Michael.

Bert Schwartz
(1924-2009)

Bertram Schwartz died February 10 at his home in Westfield, NJ. Mr. Schwartz worked as a surface chemist in the semiconductor field beginning in 1952, retiring in 1993. He was a technical group supervisor at AT&T Bell Laboratories in Murray Hill, NJ, and toward the end of his career, was a visiting professor in the Electrical and Computer Engineering Department at Rutgers University.

A member of ECS since 1957, Mr. Schwartz was given the prestigious award of ECS Honorary Member in 1991. Mr. Schwartz served as a Divisional Editor for the *Journal of The Electrochemical Society*. He received the Electronics and Photonics Division (EPD) Award in 1987 and served as

EPD chair for the 1975-77 term. He also served on the ECS Publication Committee (1984-2001) and the Ways & Means Committee (1980-1982).

Mr. Schwartz was the author or co-author of 74 technical papers and held 38 U.S. patents and 121 foreign patents. In addition, he edited two technical books.

Born in Brooklyn, NY, Mr. Schwartz graduated from New York University and did graduate studies at Columbia University and the University of Southern California. As a member of the U.S. Army Air Corps, Mr. Schwartz served in the Flying Tigers from 1943 to 1945 and was awarded the Distinguished Flying Cross, the Air Medal, and the Asiatic-Pacific Theater Campaign Medal with four battle stars. He also received the K'ang Chan-Nien Medal of the Republic of China for his actions in China during World War II.

Mr. Schwartz is survived by his wife, Sylvia, and his children, Warren and Arthur.

Roque Calvo, Executive Director of ECS, made the following comments at a memorial service for Bert Schwartz in February.

"Bert Schwartz was a member of ECS for 52 years. He was one of our most esteemed members and a friend of mine since 1982.

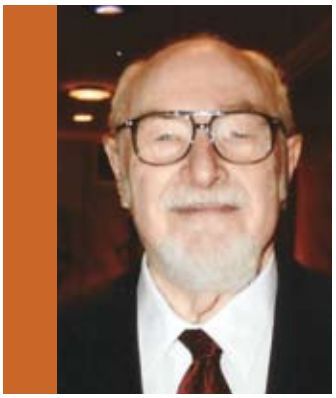
"Bert served in the usual posts for an organization like ECS… the Board of Directors, numerous committees, and he was the editor of several of our leading edge publications.

"He was well recognized for his technical achievements, which were significant. He was certainly a prolific scientist and inventor, and contributed a great deal to the body of science in our discipline.

"In 1991, Bert was recognized with our most distinguished honor when he was named an Honorary Member of ECS. I say it's the most distinguished because in the 107 year history of ECS, there have only been 76 members to receive this distinction. Among them are Thomas Alva Edison (28 year member), Leo Baekeland (Past President of ECS and inventor of Bakelite), and Gordon Moore (49 year member and cofounder of Intel).

"Bert was included among such great men of science because of his influence on a number of different developing technical areas and because of his influence on all of us who worked alongside of him in the field. He was dynamic and influential in the same way as the men with whom he shared his Honorary Member status.

"ECS as an organization has benefited significantly from his involvement. Our science has grown from his contributions and it has been my honor and privilege to have known and worked with Bert."



Harold M. Manasevit (1927-2008)

Harold (Hal) M. Manasevit died March 25, 2008 at age 80. Manasevit was born on November 1, 1927 in Bridgeport Connecticut. He received a BS degree in chemistry from Ohio University in 1950, an MS in chemistry from The Pennsylvania State University in 1951, and a PhD in physical inorganic chemistry from the Illinois Institute of Technology in 1959. He then joined the U.S. Borax Research Corp. in Anaheim, California. In 1960, he joined the Autonetics Division of the North American Aviation Corporation. He was a Member of Technical Staff in the Electronics Research Center, Autonetics Division, North American Aviation Corporation in Anaheim CA from 1960 to 1983. During this time, the company changed ownership and became North American Rockwell and then Rockwell International. In 1983, he retired from Rockwell International and joined the Thompson Ramo Woolridge (TRW) Technology Research Center, El Segundo, CA, as Senior Scientist. He retired from TRW in 1991. Dr. Manasevit published over 60 technical papers in his career, many of these appeared in the *Journal of The Electrochemical Society* and he was a member of the Society from 1972 until his death.

Manasevit's career was focused on the chemical vapor deposition (CVD) of various electronic materials. In 1963, he was the first to demonstrate the epitaxial growth of silicon on sapphire (SOS). At that time, North American Aviation was the prime contractor developing the nuclear-warhead-armed Minuteman series (Minuteman I, II, and III) intercontinental ballistic missiles (ICBMs) for the U.S. Strategic Air Command. The guidance systems for these missiles needed to be extremely reliable and it was also necessary to design an electronic control system with radiation-hardened guidance circuits so the missiles could go through nuclear bomb clouds, where there was a high concentration of intense radiation, and to survive atomic bomb impacts near the Minuteman's hardened silos.

One key feature of these guidance circuits was the need for stability in the insulating electrical properties of the semiconductor substrates in which the devices were fabricated. The use of "intrinsic" insulating silicon substrates for electronic integrated circuit fabrication was the technology of choice, but semi-insulating Si substrates suffered damage when exposed to large amounts of radiation and became electrically conducting. In response to this challenge, Manasevit had the idea of growing epitaxial silicon on a sapphire substrate, which was an insulator that is stable under nuclear radiation and is intrinsically a more stable insulator than Si. Manasevit developed and patented the heteroepitaxial chemical vapor deposition technology called silicon on sapphire, or SOS, and it was subsequently under development at Rockwell for many years for radiation-hardened-electronics applications.

Many other groups subsequently worked on SOS to develop radiation-hardened circuits for military and space applications. As an example of the important impact of the SOS technology, the farthest man-made object from the earth, the Voyager 1 spacecraft, has an RCA-built SOS microprocessor aboard it. It was launched in 1977 and left our solar system in 2003. As of February 2009 it was over 14 billion kilometers from earth and still functioning, largely due to the radiation hardness of the communications and guidance circuits.

Building upon his idea of epitaxial growth of semiconductors on insulating substrates, in 1968, Manasevit was the first to publish on the growth of semiconductors by metalorganic chemical vapor deposition (MOCVD), including the heteroepitaxial growth of GaAs on Si as well as on various insulating oxide substrates, *e.g.*, sapphire (Al_2O_3), BeO, $LiNbO_3$, and spinel. At that time, the semi-insulating GaAs substrates used for electronic devices were made using Cr doping which created deep levels in the energy gap. This doping process was not reliable and some "insulating" wafers would become conducting after processing or after high-energy radiation. Hal's idea, to grow GaAs on sapphire to solve this problem, led him to think about his PhD work on Lewis acids and bases, and of employing metalorganic sources (Lewis acids) and hydrides (Lewis bases) in a vapor-

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phase process using thermal decomposition to grow GaAs films. For his early experiments, Hal had to convince some industrial metalorganic companies to create some "high-purity" trimethylgallium and triethylgallium sources, which he used with arsine to use to grow GaAs on sapphire and other insulators. In related work, he was the first to demonstrate the growth of many of the other III-V compound semiconductors, including AlAs, AlGaAs, InP, InAlAs, AlN, GaN, and GaP, etc., on sapphire and other oxide substrates. In addition, he was the first to describe the heteroepitaxial growth of II-VI and IV-VI compound semiconductors on insulators and the first to produce superconducting films on insulators. He also developed numerous CVD techniques for etching insulators, *e.g.*, the RF plasma etching of oxides in 1966.

MOCVD has been subsequently explored by many other workers and for many applications, *e.g.*, light-emitting diodes (LEDs), injection lasers, solar cells, heterojunction bipolar transistors, etc. For example, MOCVD was used to create the high-efficiency triple-junction GaAs-based solar cells on the Spirit and Opportunity Mars Rovers, which arrived on Mars in January 2004, and were still operating in February 2009, well beyond their expected lifetime. As another example of the impact of Dr. Manasevit's innovations, MOCVD is used today in the mass production of blue- and green-light-emitting diodes made of GaN-based heteroepitaxial layers grown by MOCVD on sapphire, a process he pioneered in 1971 and which was subsequently improved on and developed commercially by other workers.

Hal created the term "MOCVD" to indicate that the chemical vapor deposition process he pioneered was an extremely flexible approach and could be used to deposit a wide range of materials, including epitaxial, polycrystalline, and amorphous materials. Today, MOCVD is used widely for all of these types of materials, including semiconductor epitaxial layers and amorphous dielectric films. For example, MOCVD is used extensively for the homo- and heteroepitaxial growth of III-V compound semiconductors and also in the Si-integrated circuit industry for a variety of applications related to dielectric film deposition.

The impact of Hal's work on MOCVD is truly extensive. The MOCVD process that he pioneered is the dominant materials technology used for the commercial production of LEDs, injection lasers of all types, compound-semiconductor solar cells, advanced high-speed bipolar transistor electronics, avalanche photodiodes, as well as for the deposition of various coatings and thin films. In fact, MOCVD is the dominant III-V epitaxial materials growth technology used in the world today and is used for the production of billions of dollars of products each year.

Manasevit held 16 patents, and was awarded the 1985 IEEE Morris N. Liebmann Memorial Award "for pioneering work in metalorganic chemical vapor deposition, epitaxial-crystal reactor design, and demonstration of superior quality semiconductor devices grown by this process." He received the Illinois Institute of Technology Alumni Award in 2009.

On the personal side, Hal's coworkers and associates knew him as a very friendly and open colleague who would share information, ideas, and lab equipment with others. He was a true scientist and his interests focused on the underlying physics and chemistry of how materials growth processes work. He was supported in his personal life by his wife, Cookie, who preceded him in death. He is survived by his daughters, Beryl (Avery) Schlesenberg and Sharon (Donald) Strauss, and his son, Steve; as well as three granddaughters; and two sisters, Estelle Horwitz and Rhoda Cohen.

This memorial notice was contributed by Russell D. Dupuis, Georgia Institute of Technology.

In Memoriam

S. N. Flengas (b. 1925), High Temperature Materials Division, member since 1980.

Albert Himy (1922-2008), Emeritus, Battery Division, member since 1962.

Raymond C. Petersen (1929-2009), Emeritus, Energy Technology Division, member since 1957.

Sai Peng Wong (1956-2007), Electronics & Photonics Division, member since 1998.

In the NEXT *issue of* INTERFACE

- A special issue on **Solid Oxide Fuel Cells**, including these articles: "Solid Oxide Fuel Cell Commercialization, Research, and Challenges," by **E. D. Wachsman** and **S. C. Singhal**; "Toward the Miniaturization of Solid Oxide Fuel Cells," by **E. Traversa**; and "From Laboratory Breakthrough to Technological Realization: The Development Path for Solid Acid Fuel Cells," by **C. R. I. Chisholm**, **D. A. Boysen**, **A. B. Papandrew**, **S. Zecevic**, **S.-Y. Cha**, **K. Sasaki**, **Á. Varga**, **K. P. Giapis**, and **S. M. Haile**.

- **The 216th ECS Meeting will be held in Vienna, Austria**, October 4-9, and the next issue will feature a special meeting section, with information on the technical program, short courses, and the main speakers: **Martin Stratmann**, Director of the Max-Planck-Institut für Eisenforschung in Düsseldorf, who will deliver The ECS Lecture at the Plenary Session; **Dieter M. Kolb**, Director of the Institute of Electrochemistry, University of Ulm, who will give the Olin Palladium Award Address; and **David Shoesmith**, the Canadian Natural Sciences and Engineering Research Council and Nuclear Waste Management Organization Industrial Research Chair holder in Nuclear Fuel Disposal Chemistry, who will speak on "Electrochemistry and the Performance Assessment of Nuclear Waste under Permanent Disposal Conditions."